

April 5, 1960

A. E. MILLER ET AL
SYSTEM FOR AUTOMATICALLY PRESENTING A BREATHING
MASK TO A PERSON IN AN EMERGENCY

2,931,355

Filed June 24, 1957

5 Sheets-Sheet 1

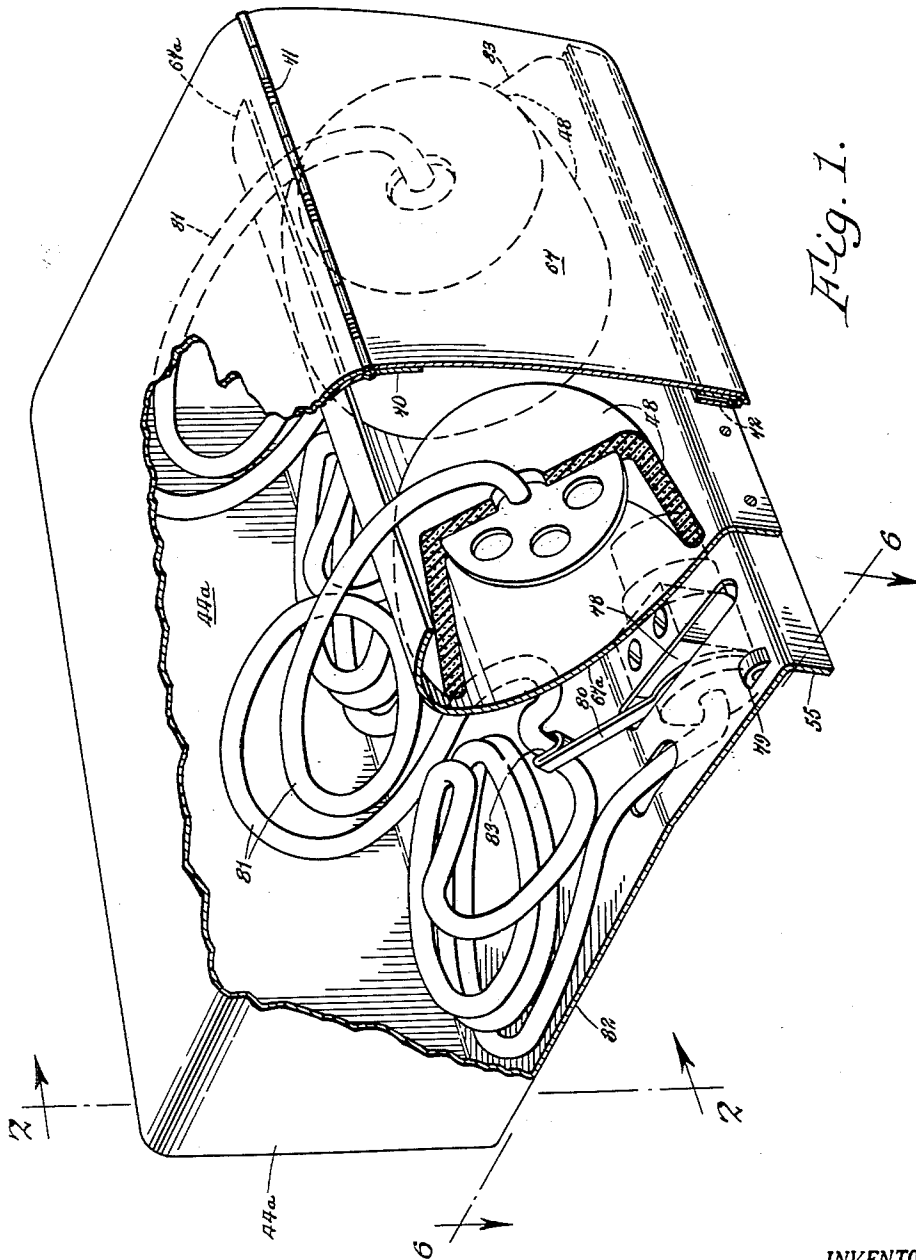


Fig. 1.

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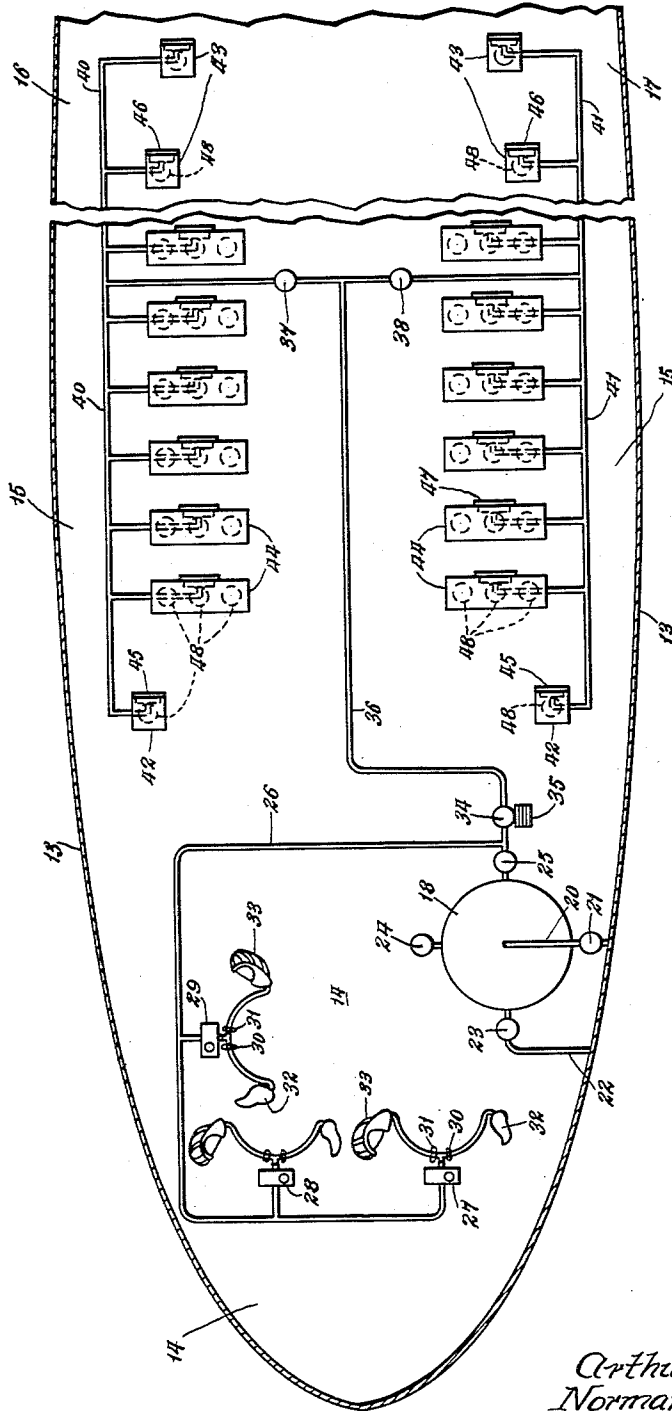


Fig. 1a.

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Fig. 3.

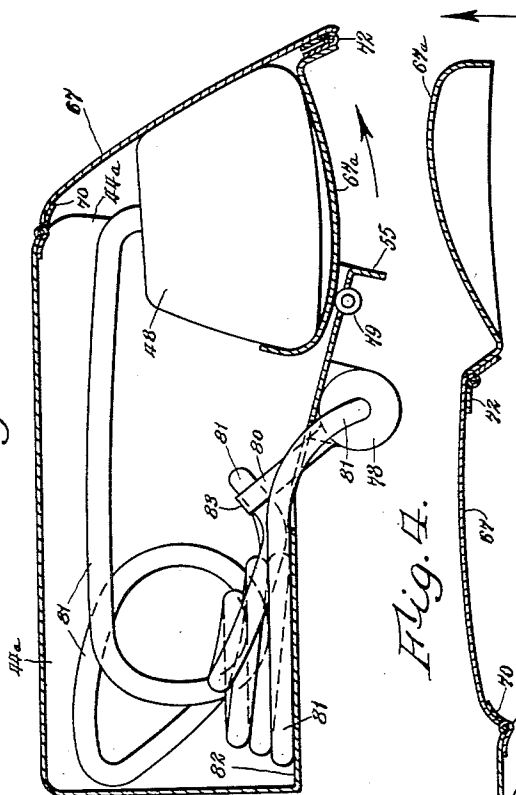


Fig. 4.

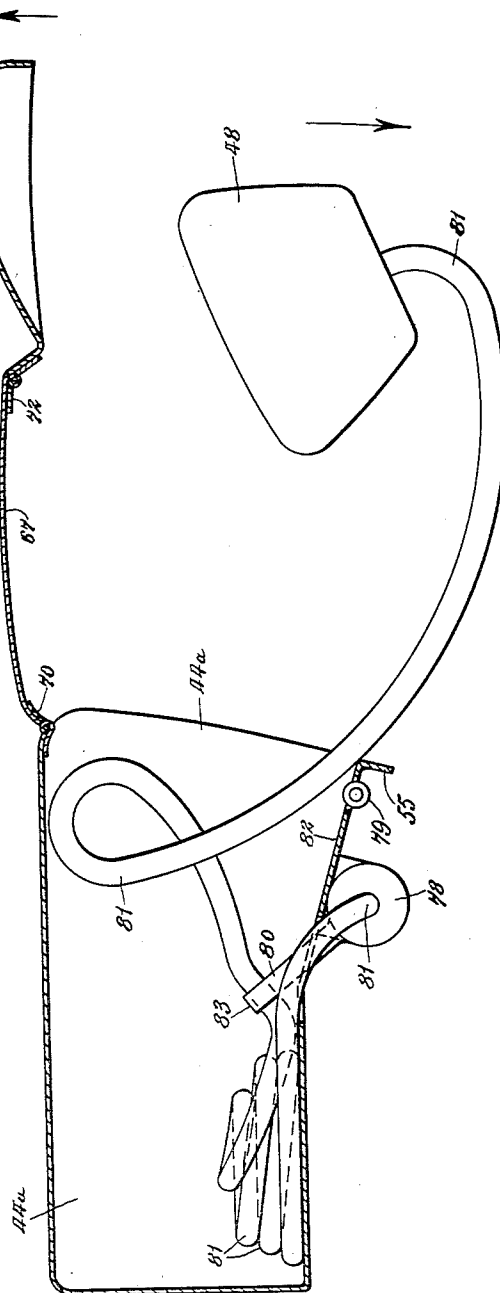
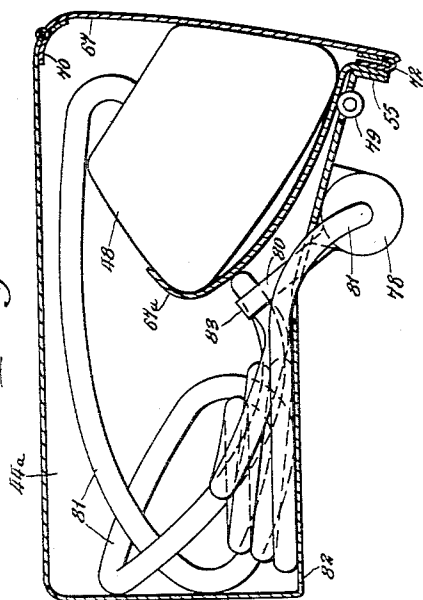


Fig. 2.



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Fig. 5.

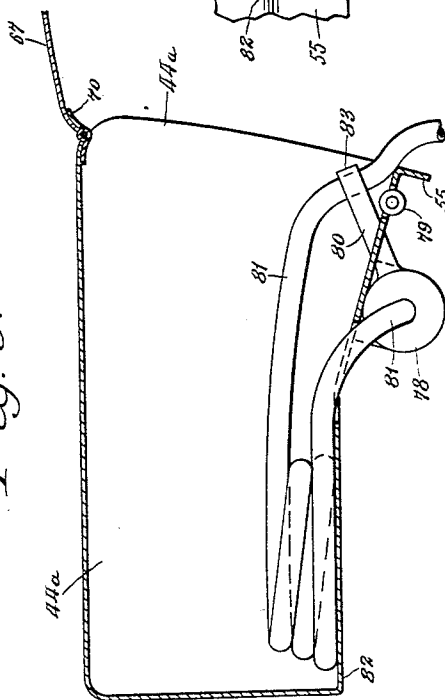


Fig. 7.

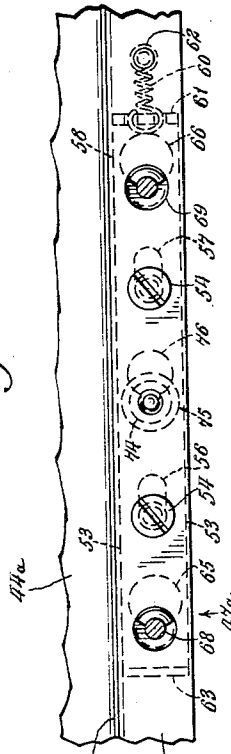
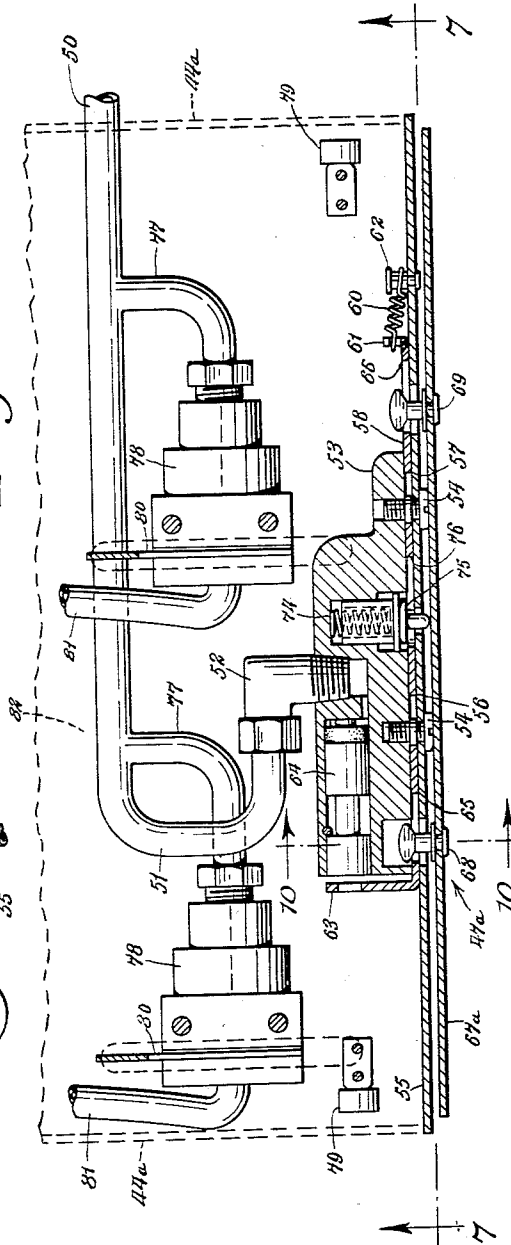


Fig. 6.



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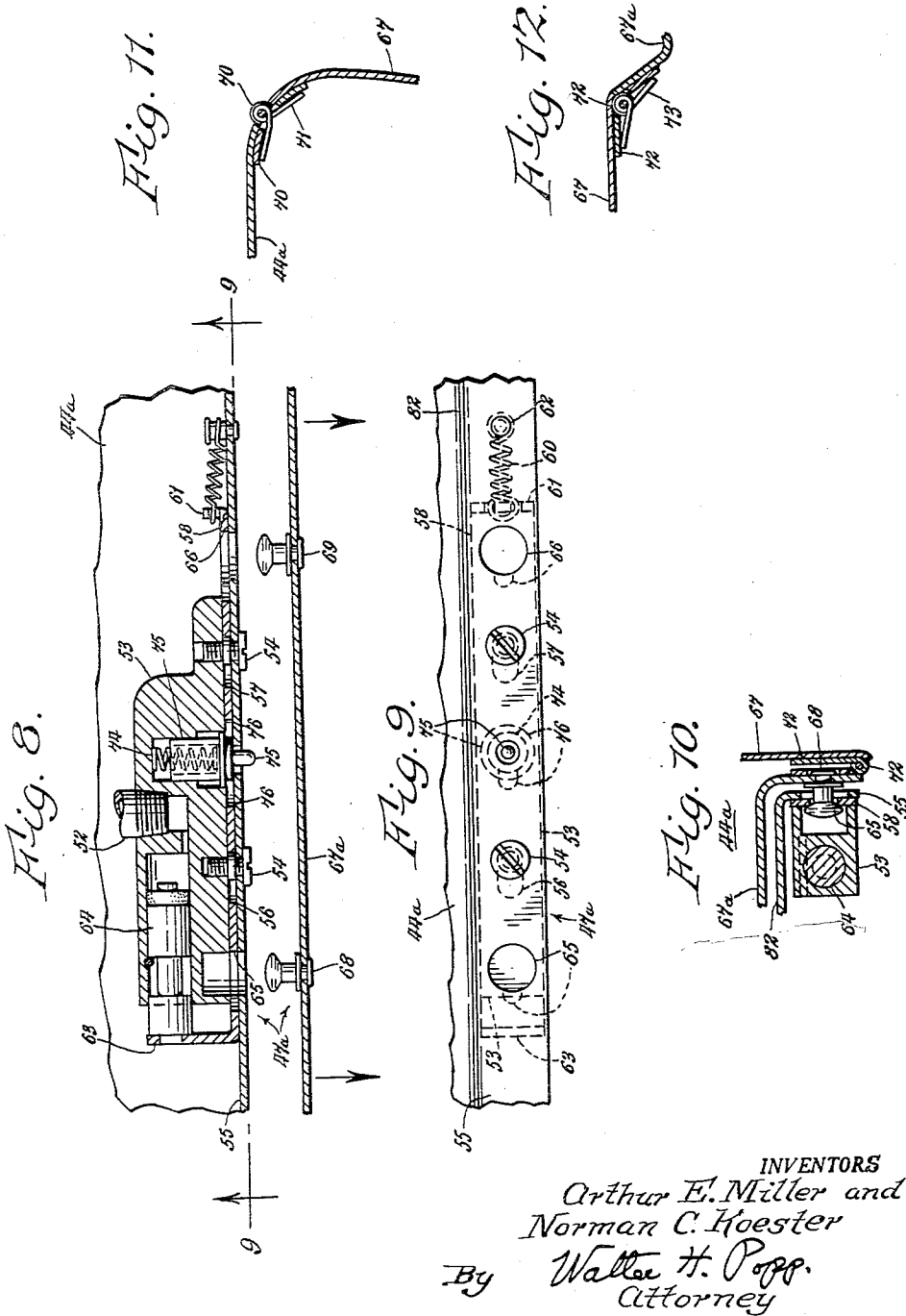
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SYSTEM FOR AUTOMATICALLY PRESENTING A BREATHING MASK TO A PERSON IN AN EMERGENCY

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Application June 24, 1957, Serial No. 667,401

6 Claims. (Cl. 128—142)

This invention relates to a means for providing breathing masks, in an emergency, to persons requiring the same, and relates in particular to a system for providing breathing masks to persons in the cabin of a pressurized airplane whenever the pressure in said cabin accidentally drops suddenly to ambient pressure due to a rupture in the cabin wall or to a failure in the airplane's pressurizing system.

The main object of the invention is to automatically present an emergency, individual, breathing mask to each of the passenger seats of a pressurized airplane whenever the cabin pressure suddenly drops, and in such manner that no oxygen or other breathing fluid flows into said mask until each individual passenger desiring to use his breathing mask pulls down his individual mask and then places it upon his face, and, in so doing, automatically turns on a supply of breathing fluid to said individual mask. A further object of the invention is to enable each passenger, in an emergency, to be provided with a type of breathing mask which is very inexpensive but because of this fact is somewhat wasteful in its use of breathing fluid while being used.

Still another object of the invention is to normally house all of such emergency, passenger masks in compartments where they can be stored free of dust and inquisitive fingers, and yet be expelled from said compartments and dropped down in front of the passengers whenever an emergency occurs. Further collateral objects of the invention and practical solutions thereof are explained in the following description and illustrated in the appended drawings, wherein:

Fig. 1 is a diminutive perspective view (with parts broken away) of an overhead portion of a compartment 44a which is adapted to hold a pair of emergency, orifice-type, oronasal, breathing masks. In this view the door latching mechanism 47a has been omitted for purposes of clarity.

Fig. 1a is a schematic fragmentary, horizontal section thru a typical pressurized airplane 13 illustrating one form of installation of our invention.

Fig. 2 is a vertical, transverse section thru said dual mask compartment 44a, with the door latching mechanism omitted, taken on line 2—2 Fig. 1; the compartment door 67 and hinged mask shelf 67a in this figure being shown in their normal or closed positions.

Fig. 3 is a vertical, transverse section thru aforesaid dual mask compartment 44a similar to Fig. 2 but showing the compartment door 67 and hinged mask shelf 67a in their partially opened positions.

Fig. 4 is also a vertical, transverse section thru aforesaid dual mask compartment 44a similar to Fig. 2 but showing the compartment door 67 and hinged mask shelf 67a in their fully opened positions and with one of the individual emergency masks 48 shown falling down toward a position in front of the face of one of the airplane passengers. In this figure the oxygen valve 78 is still closed.

Fig. 5 is a fragmentary, vertical, transverse section thru

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the aforesaid dual mask compartment 44a somewhat similar to Fig. 4 but showing one of the emergency mask oxygen hoses 81 pulled partly down and its individual oxygen valve 78 turned to its fully open position.

Fig. 6 is a fragmentary, horizontal section, looking down below the floor 82 of aforesaid, dual mask compartment 44a taken on line 6—6 Fig. 1. For the sake of clarity the compartment door 67 and the spring-loaded hinge 73 have been omitted in this figure.

Fig. 7 is a fragmentary, vertical section looking forwardly of the airplane toward the downturned flange 55 of the floor 82 of aforesaid compartment 44a, taken on line 7—7 Fig. 6.

Fig. 8 is a fragmentary, horizontal section, looking down below the floor 82 of said compartment 44a, somewhat similar to Fig. 6 but showing the door latch 47a in its unlatched position. The hinged door 67 and the hinge 73 have been omitted in this figure for purposes of clarity just as in Fig. 6.

Fig. 9 is a fragmentary, vertical section looking forwardly of the airplane toward the downturned flange 55 of the floor 82 of aforesaid compartment 44a and somewhat similar to Fig. 7 but showing the door latch 47a in its unlatched position, taken on line 9—9 Fig. 8.

Fig. 10 is a fragmentary, vertical section thru the latching mechanism 47a taken on line 10—10 Fig. 6, showing said latch 47a in its latched position.

Fig. 11 is an enlarged, vertical, transverse section thru the spring-loaded hinge 70 of the door 67 which is shown in the closed position of said door illustrated in Figs. 1 and 2.

Fig. 12 is an enlarged, vertical, transverse section thru the hinge 72 of the hinged mask shelf 67a, shown in the fully open position of said hinged mask shelf illustrated in Fig. 4.

To simplify the specification of this invention it will be explained exactly as it is illustrated, but it is to be understood that the breadth of the invention is to be measured solely by its patentable novelty and by the scope of the appended claims.

The main wall or shell 13 of the airplane fuselage encloses a flight crew "deck" 14; a passenger compartment 15; and a pair of rear service cabins 16 and 17.

Arranged in the rear, port side of the flight crew "deck" 14 is a liquid oxygen storage and evaporating apparatus which, for convenience, we will call a breathing-fluid, supply tank 18. This tank is filled with a breathing fluid (such as liquid oxygen) thru an inlet pipe 20 under the control of an inlet valve 21, and is vented through a vent pipe 22 under the control of a vent valve 23. The customary tank-pressure gage 24 is also provided.

Breathing fluid emanating from the breathing-fluid supply tank 18 first passes thru the usual fluid pressure regulator 25 where its pressure is reduced to say 70 p.s.i. Said breathing fluid then passes thru a lateral feed pipe 26 and is carried to three diluter demand regulators 27, 28 and 29 located on the walls of the flight-crew "deck" 14. From each demand regulator the breathing fluid passes into a T fitting and thence to a pair of companion outwardly-opening check valves 30, 31. Each check valve 30 is connected thru a flexible hose to a demand-type oronasal mask 32, while each check valve 31 is connected thru a flexible hose to a demand-type, full-face mask 33. Each oronasal mask 32 can be clapped to the aviator's face very quickly, and is used when sudden, accidental decompression occurs. Each full face mask is adapted to be used either after sudden decompression while the airplane is being pointed downwardly or for normal navigation use whenever oxygen is desired over a relatively long period of time.

The check valves 30, 31 prevent any partial vacuum in any one of any pair of masks 32, 33 from being trans-

mitted to its companion mask 32 or 33 as the case may be, which action, if it did occur, would prevent any breathing fluid from being sucked out of its companion, demand regulator (27, 28 or 29).

Breathing fluid from the fluid pressure regulator 25 is also tubularly connected to an emergency valve 34 which is controlled by an aneroid 35 in such manner that if the pressure in the passenger compartment 15 should accidentally be "lost" while the plane is at a high elevation, said aneroid 35 will open said emergency valve 34 and allow oxygen at 70 p.s.i. to flow into an oxygen feed pipe 36.

Whenever there is sufficient decompression in the passenger compartment 15 to cause the aneroid 35 to open the emergency valve 34, oxygen at 70 p.s.i. flows from the oxygen feed pipe 36 to a pair of constant-flow regulators 37, 38, and thence to branch pipe lines 40, 41. Each of these branch lines feeds oxygen into a pair of one-mask, box-like containers, pods or compartments 42 for use by the stewardesses, and also into a battery of three-mask compartments 44 for use by the passengers, and also into a number of one mask compartments 43 located in the service cabins 16 and 17.

Whenever the emergency oxygen valve 34 is opened by its aneroid 35, oxygen under pressure is caused to flow into the branch lines 40, 41 and thence to the various mask compartments 42, 43, and 44, and this pressure both opens the compartment door latches 45, 46, and 47 and also automatically discharges their constant-flow, oronasal masks 48 as will be now explained.

For convenience, we will now assume that each passenger mask compartment 44 is a two-mask compartment 44a, as shown in Figs. 1-5 incl., and that oxygen from the oxygen branch lines 40, 41 is fed into each compartment supply pipe 50 (see Fig. 6) whenever the emergency valve 34 is opened. Each of these supply pipes 50 feeds oxygen into an unlatching oxygen pipe 51 which carries the oxygen to an L pipe fitting 52 that is threaded into a latch casing 53. The latter is rigidly secured by screws 54 to the inner vertical face of a down turned flange 55 which is formed at the "front" lower corner of its companion compartment 44a.

The central collars of the screws 54 are received within a pair of short, longitudinal slots 56 and 57 that are formed in the main portion of a sheet metal slide 58, and thus these collars act as guides for said slide 58. In Figs. 6 and 7 this slide 58 is shown in its latched position, and is resiliently held in this latched position, by a tension spring 60 whose opposite ends are connected respectively to an upturned flange 61 formed at the rear end of said slide and to an anchor post 62 riveted to the downturned flange 55 of the floor 82 of the compartment 44a.

The front (left) end of the slide 58 is formed to provide a laterally projecting flange 63 which is adapted to be pushed forwardly by a piston 64 whenever oxygen under pressure flows into the latch casing 53 from the L pipe fitting 52. This occurs whenever the emergency valve 34 is opened. The main body of the slide 58 is provided with a pair of key-hole slots 65, 66, the narrow front portions of which normally (when the door 67 of the compartment is closed, see Figs. 6 and 10) receive the necks of a pair of latching posts 68, 69. The heads of these posts are considerably larger than the narrow parts of the key-hole slots 65, 66, and hence any outward or opening movement of the compartment door 67 or hinged mask shelf 67a is prevented when the slide 58 is in the position of Figs. 6, 7, and 10.

Said compartment door 67 is hinged at its upper edge on the compartment 44a on a hinge 70 and is resiliently urged towards its open position by a plurality of torsion springs 71 (see Figs. 11 and 1-5 incl.). But opening of the door 67 is prevented until oxygen under pressure surges into the latch casing 53 and pushes its piston 64 forwardly so as to push the slide 58 forwardly and

thereby allow the heads of the posts 68, 69 to move outwardly through the large portions of the key-hole slots 65, 66. This allows the compartment door 67 to open up wide under the influence of its torsion springs 71.

The posts 68, 69 are not, however, directly connected with aforesaid door 67 but, instead, are riveted to a hinged mask shelf 67a (see Figs. 10, 6 and 8). The latter is hinged on a hinge 72 to the outer horizontal edge of said compartment door 67, and is resiliently urged to rotate counter-clockwise relatively thereto by the provision of plurality of torsion springs 73 (see Fig. 10). Hence, as soon as the hinged mask shelf 67a, together with its posts 68, 69, is disconnected from or freed from the slide 58, both said hinged mask shelf 67a and said door 67 are resiliently flung open to their fully opened positions as best illustrated in Figs. 2 thru 4.

The latch casing 53, together with its appurtenances and in combination with the posts 68, 69 and the door 67 and hinged mask shelf 67a constitute the latch 47a. After the emergency valve 34 has been opened, all of the latches 45, 46, 47 (and 47a) are exposed to the full 70 p.s.i. pressure in the oxygen feed pipe 36, and, as the travel of all of the pistons 64 is very short, it is obvious that even if the latches do not open precisely simultaneously they do all open within a very short period of time of each other. For reasons which will shortly be explained, there will be a flow of oxygen thru at least some of the oxygen supply pipes 50 subsequent to the opening of the latches, and the pressure in the oxygen supply pipes 50 will drop somewhat because of the constant flow regulators 37, 38. Because of this condition it is desirable that, when any one latch 47a has been opened, it stays open until its door 67 and hinged mask shelf 67a are closed, as otherwise the slide 58, if moved to its latched position under the influence of its tension spring 60, would prevent closing of said door and hinged mask shelf. This effect is prevented as follows:

Arranged to slide horizontally in the latch casing 53 is a cylindrical detent head 75 which is resiliently urged outwardly by a compression spring 74. The outer thin end of said detent head 75 is normally received within the narrow end of a detaining, key-hole slot 76, but the main body of said detent head is normally prevented from moving outwardly because its main diameter is greater than the width of said narrow part of said detaining key-hole slot 76. When, however, the latch 47a is unlatched by the forward (left) movement of its slide 58, the lower part of the main body of the detent head 75 moves outwardly thru the large diametered part of the key-hole slot 76 from the normal or latched position of Figs. 6 and 7 to the unlatched position of Figs. 8 and 9. This means that the latch 47a cannot be related by a rearward movement of its slide 58 until the detent head 75 has been pushed back by the hinged mask shelf 67a to the normal or latched position of the latch under the influence of the tension spring 60 which retracts the slide 58 of said latch to its normal, or latched position.

Leading off from each oxygen supply pipe 50 is a pair of mask, supply pipes 77 which convey the oxygen to a pair of rotary valves 78 each of which is adapted to be opened or closed by a companion valve arm 80, which latter is shown in its closed position in all the figures which illustrate it except Fig. 5 where it is shown in its open position. Each valve 78 controls the flow of oxygen into a companion, flexible, mask hose 81 which is normally coiled up on the floor 82 of the compartment 44a and terminates in a companion oronasal mask 48, which, in the form illustrated, is made of a truncated hollow cone of sponge rubber. Such a mask taken in combination with the constant-flow regulators 37, 38, is much cheaper than one of the demand masks 32 or 33 taken in combination with its companion demand regulator 27, 28, or 29. This is of importance because an ordinary passenger airplane requires a very large number of oronasal masks 48 and they are of service only in very

rare emergencies and hence would normally tie up too much capital in an inactive capacity.

Normally, these masks 48 rest upon their companion hinged mask shelf 67a, but, when the emergency valve 34 is opened and oxygen flows into the latch 47a the latter is unlatched and the door 67 and hinged mask holder or shelf 67a caused to be flung wide open under the influence of their torsion springs 71 and 73. As the masks 48 are then unsupported, they fall by gravity (see Fig. 6) out of the compartment 44a and down in front of but just above the faces of the passengers below. During this opening operation the weight of the hinged mask shelf 67a and its burden of masks 48 is carried on a pair of rollers 79 which are journaled in the floor 82 of the compartment 44a.

It should be noted that this falling down of the relatively light masks 48 does not open the rotary valves 78 (see Fig. 4). This means that there is no wastage of oxygen in the event that there are no passengers for some of the masks, or if, for some reasons, some of the passengers do not immediately seize their masks and clap them to their faces. However, when any individual passenger desires to use his individual mask which has been dropped down almost to his face, he merely grasps said mask and pulls it down and puts it on his face. This action concomitantly pulls down on his flexible oxygen hose 81, and the latter, being frictionally but detachably held in the clip 83 (see Fig. 1) at the outer end of his individual valve lever 80, causes the arm 80 of the comparison rotary valve 78 to swing clockwise from its closed position (as in Figs. 1 thru 4) to its open position (as in Fig. 5). Even after he has applied the mask to his face and is receiving oxygen from the oxygen valve 78 which has now been opened, there is still some flexible hose 81 still coiled upon the floor 82 of the compartment 44a as shown in Fig. 5. This extra hose he can then utilize, if he desires, by simply pulling the mask down further.

While the invention as here illustrated shows an emergency valve 34 which is automatically opened by an aneroid 35, it should be understood that this aneroid can be dispensed with and said emergency valve 34 opened directly manually. One of the vital features of the present invention is that all of the mask compartments are opened almost simultaneously by the opening of the single emergency valve 34. The main feature of the invention is, of course, the automatic presenting, in an emergency, of masks 48 to the passengers with no oxygen flowing into any mask until the passenger, to which this individual mask is presented, manually pulls down his mask and slaps it onto his face. It is this final, manual action which enables oxygen to start flowing into his mask.

It is deemed obvious that this invention is not necessarily confined to a pressurized airplane, but can be used wherever it is desirable to present breathing masks 48 to one or more persons, automatically or otherwise, as

for instance in a crowded indoor theater being flooded with noxious gases or air-borne atomic debris, or in an outdoor theater immersed in smog.

We claim:

1. A mask providing system of the character described comprising: a tank of breathing fluid; an emergency valve tubularly connected with said tank and having an aneroid which opens said valve when the pressure of the atmosphere surrounding said aneroid changes beyond a predetermined point; a breathing mask tubularly connected with said valve and adapted to be presented operatively to an adjacent person but normally held in its inoperative position by a latch which is automatically opened when the pressure in the discharge end of the emergency valve increases.

2. As in claim 1 with the mask being contained within a compartment having a door which is normally held in its closed position by the latch.

3. As in claim 1 with the mask being contained within a compartment having a spring loaded door which is controlled by the latch and which flies open when said latch is opened.

4. A mask providing system of the character described comprising: a mask compartment having a breathing fluid valve provided with a valve arm; a mask tube adapted to be supplied with breathing fluid in an emergency and detachably connected with said valve arm; a mask tubularly connected with said mask tube and adapted to be discharged from said compartment without its tube actuating said valve arm, the arrangement being such that, when a person seizes said mask and pulls it down, the mask tube actuates the valve arm.

5. As in claim 4 with the valve arm being detachably connected to the mask hose intermediate the length of said mask hose.

6. A mask providing system of the character described comprising: a compartment having a door with a spring loaded hinge; a mask-supporting shelf pivoted on the outer edge of said door on a spring loaded hinge; a breathing mask normally supported on said shelf; a compartment latch adapted to normally hold said door closed; and means for supplying breathing fluid to said mask after the door has been opened.

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